

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF MISSOURI
EASTERN DIVISION

A.O.A., <i>et al.</i> ,)	
)	Case No. 4:11-cv-00044-CDP
Plaintiffs,)	(CONSOLIDATED)
)	
v.)	
)	
THE DOE RUN RESOURCES)	
CORPORATION, <i>et al.</i> ,)	
)	
Defendants.)	

**DEFENDANTS’ BRIEF IN OPPOSITION TO PLAINTIFFS’ MOTION TO EXCLUDE,
IN PART, THE EXPERT OPINIONS OF DR. SHAHROKH ROUHANI**

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I. INTRODUCTION

Plaintiffs have moved to exclude a discrete portion of Dr. Shahrokh Rouhani's opinions relating to his statistical evaluation and comparison of the air quality models created by David Sullivan, Plaintiffs' modeling expert. (Dkt. Nos. 1247, 1248.) Specifically, Plaintiffs argue that Dr. Rouhani's comparison of Mr. Sullivan's modeled air concentrations with actual measured values from air monitoring sites for the same dates and times (*i.e.*, concurrent comparisons) is improper. (Dkt. No. 1248 at 1.) Plaintiffs' motion fails for a variety of reasons, as detailed below, but the central defect with their argument is that Dr. Rouhani's methodology for model evaluation is fully consistent with and endorsed by the peer-reviewed scientific literature and generally accepted in the industry. Indeed, to understand the state of the science here, one need look no further than Plaintiffs' own citation to J.C. Chang & S.R. Hanna, *Air Quality Model Performance Evaluation*, 87 Meteorol. Atmos. Physics 167 (2004) ("Chang & Hanna") (Ex. A).

As Professors Chang and Hanna explain: "Multiple performance measures should be applied and considered in any model evaluation exercise, as each measure has advantages and disadvantages and there is not a single measure that is universally applicable to all conditions." *Id.* at 173. That is precisely what Dr. Rouhani did. Rather than stop his analysis after having completed his nonconcurrent comparisons not tied to the same date and time (which Plaintiffs do not seek to exclude, and which also demonstrate that Mr. Sullivan's modeling is not reliable), Dr. Rouhani proceeded as part of his broader evaluation to perform a concurrent comparison. As to concurrent comparisons specifically, Chang and Hanna explain that there are circumstances in which it is important to determine not simply the overall potential exposure to a population, but "the location and shape of the concentration field." *Id.* at 185. Indeed, where an expert purports to "prove" an individual's exposure, the location and shape of emissions are essential. "This is

the reason why despite the challenge due to uncertainty in wind direction, *there is nevertheless an interest in the paired in space or time comparisons.*” *Id.* (emphasis added).

In short, Plaintiffs are fundamentally mistaken as to the value of concurrent comparisons. And their motion to exclude any portion of Dr. Rouhani’s testimony should be rejected.

II. FACTUAL BACKGROUND

Dr. Rouhani is an expert environmental statistician with more than four decades of experience in the field. He received his Ph.D. in Environmental Sciences from Harvard University, served for many years as a tenured Professor in the School of Civil and Environmental Engineering at the Georgia Institute of Technology, and co-founded NewFields Companies, LLC, a leading environmental consulting firm where he continues to serve as President. Dr. Rouhani has spent his entire career in the fields of geostatistics, environmental statistics, and data analysis involving all manner of media, including air. Defendants retained Dr. Rouhani in this case to address the reliability of statistical claims and conclusions offered by several of Plaintiffs’ experts. Dr. Rouhani’s opinions are set forth in two expert reports: (1) Expert Report of Shahrokh Rouhani, Ph.D., P.E., dated November 26, 2019 (“Rouhani 2019 Report”) (Ex. B); and (2) Expert Report of Shahrokh Rouhani, Ph.D., P.E., dated March 19, 2021 (“Rouhani 2021 Report”) (Ex. C). Plaintiffs have not moved to exclude any portion of Dr. Rouhani’s 2019 Report. Instead, Plaintiffs have moved to exclude only a relatively small portion of Dr. Rouhani’s 2021 Report, namely, the opinions discussed in paragraphs 22 to 28. (Dkt. No. 1248 at 1.) The remaining portions of Dr. Rouhani’s 2021 Report are thus not at issue.

The paragraphs in Dr. Rouhani’s 2021 Report that Plaintiffs do object to pertain to statistical opinions offered by Plaintiffs’ air quality modeler, David Sullivan. As pertinent here, and by way of background, Mr. Sullivan undertook two primary tasks for Plaintiffs. First, Mr.

Sullivan attempted to reconstruct an historical inventory of air emissions for certain constituents (such as lead, arsenic, and sulfur dioxide (“SO₂”)) released from the La Oroya Complex during the time it was owned and operated by Doe Run Peru (“DRP”) (roughly between 1997 to 2009). Second, Mr. Sullivan used that reconstructed air emission inventory to perform air quality computer modeling to try and predict the presence of various constituents in the air at locations surrounding the La Oroya Complex, including places where Plaintiffs lived and attended school. As part of this latter task, Mr. Sullivan claimed to have compared (in an unspecified and unproven way) his latest round of modeling predictions to the measured air quality data collected from air monitoring stations near the La Oroya Complex during DRP’s operations. (Dkt. No. 1248-5, Expert Report of David A. Sullivan, dated Dec. 1, 2020, at 26 (“Sullivan Dec. 2020 Report”).) In addition, Mr. Sullivan claims to have compared (again, in an unspecified and unproven way) his new modeling results to prior modeling efforts, including work involving the late Dr. Nicholas Cheremisinoff, who collected and compiled La Oroya air data, and Dr. George McVehil, an air modeler who assisted DRP during its period of operations. (*Id.*)

Based on these comparisons—both “model-to-measured” and “model-to-model”—Mr. Sullivan proffered generic, conclusory, unsupported, and unevidenced statistical opinions about the accuracy and reliability of the air quality models he prepared for use in this litigation.

A. Model-to-Measured Comparisons

As for his model-to-measured comparisons, Mr. Sullivan asserted in his December 2020 Report that his predicted results are “generally consistent with the ... measured air quality data for lead and SO₂” (while “relatively low” for arsenic). (Sullivan Dec. 2020 Report at 26.) He did not, however, provide any basis for this conclusion. Only later, in his 2021 Rebuttal Report, did Mr. Sullivan even reference his “target accuracy goal of plus or minus a factor of two.” (Dkt. No. 1248-6, David A. Sullivan Rebuttal Report, dated May 28, 2021, at 65 (“Sullivan 2021

Report”).) The factor-of-two test simply means that the modeled result should be no less than half of the measured result (that is, the measured result divided by two) and no more than double the measured result (the measured result multiplied by two).¹ Tellingly, Mr. Sullivan did not provide any evidence or analysis demonstrating compliance with this factor-of-two test. That failure is not surprising as virtually every key modeled prediction cited in Mr. Sullivan’s December 2020 Report failed that test, meaning that his predictions were either less than half or more than double the corresponding measured values. (Rouhani 2021 Report ¶¶ 24, 27.)

In response to Mr. Sullivan’s Report, Dr. Rouhani evaluated the reliability of Mr. Sullivan’s modeling efforts using two primary methods: “nonconcurrent comparisons” and “concurrent comparisons.” For nonconcurrent comparisons, the time period used for the modeled value need not match that of the measured result. For example, a nonconcurrent comparison of the annual maximum three-month rolling average for a given year might compare the modeling predictions from February to April to measured results from September to November, an entirely different period of time and season of the year, involving different wind patterns, different rainfall, different average temperatures, and so forth. This method of comparison is obviously less stringent in that it accounts for more modeling errors and inaccuracies.

Even under this more forgiving standard, however, Mr. Sullivan’s recent air models for lead, arsenic, and SO₂ all fail his own factor-of-two test. (*Id.* ¶¶ 18–21, Table 5, & Attachment

¹ For example, as shown in Table 5 of Dr. Rouhani’s 2021 Report, the three-month maximum rolling average for air lead concentration in 2007 at the Sindicato Station (the air monitoring station closest to the La Oroya Complex) is 2.09 µg/m³. (Rouhani 2021 Report at 8.) To satisfy the factor-of-two test, the Sullivan-Sullivan modeled result must thus fall within a range of half of the measured 2.09 value ($2.09 / 2 = 1.045$) or double the measured value ($2.09 \times 2 = 4.18$). Mr. Sullivan’s modeled result of 4.48 µg/m³ overestimated air lead concentration at Sindicato by 115%, more than double the measured result, and thus failed the factor-of-two test, even using a maximum annual three-month rolling average in a nonconcurrent comparison.

B.) The results for lead, for example, using this nonconcurrent comparison are set forth in Dr. Rouhani's Table 5. Mr. Sullivan's latest predicted lead results are contained in the column designated "Sullivan-Sullivan." As shown below, all of his predicted results but one fail the factor-of-two test.

Table 5. Nonconcurrent Comparison of Mr. Sullivan's Predicted 3-Month Maximum Lead Values vs. Measured Values ($\mu\text{g}/\text{m}^3$)
% Difference = (Predicted – Measured)/Measured

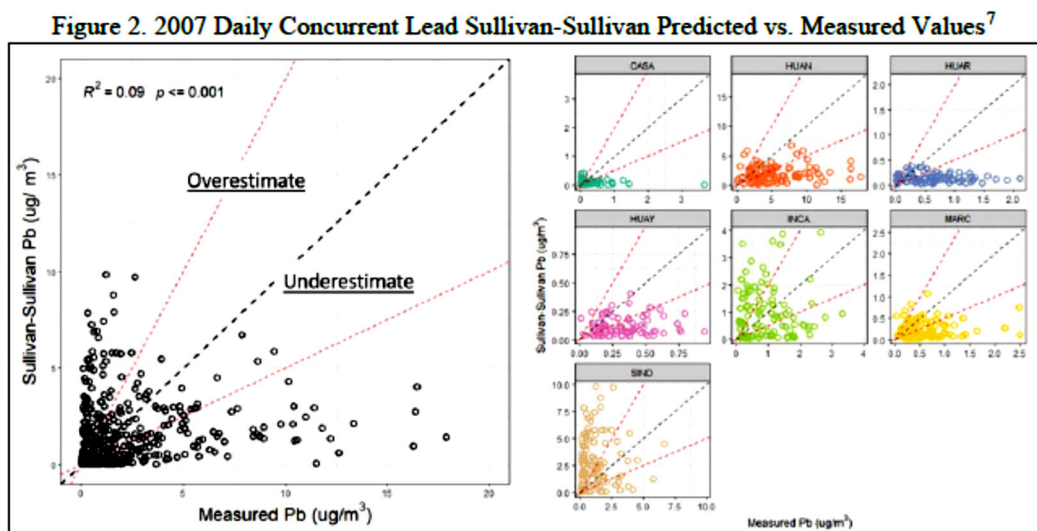
Highlighted values exceed 40% difference between predicted value and measured value.

Station	Measured	<u>Sullivan-McVehil</u>		<u>Sullivan-Cheremisinoff</u>		<u>Sullivan-Sullivan</u>	
		Predicted	% Difference	Predicted	% Difference	Predicted	% Difference
INCA	1.27	0.64	-50%	1.02	-20%	1.23	-4%
HUAN	6.47	0.96	-85%	1.92	-70%	2.44	-62%
CASA	0.42	0.08	-82%	0.08	-82%	0.13	-69%
MARC	1.03	0.17	-83%	0.21	-79%	0.37	-64%
HUAR	0.77	0.08	-90%	0.08	-90%	0.18	-76%
SIND	2.09	5.92	+184%	5.08	+144%	4.48	+115%
HUAY	0.45	0.10	-77%	0.10	-77%	0.18	-59%

(*Id.* at 8, Table 5.) Significantly, Plaintiffs have not sought in their motion to exclude this portion of Dr. Rouhani's opinions.

Dr. Rouhani, however, did not stop the analysis there, as Plaintiffs seem to believe he should have. To better understand Mr. Sullivan's model and its inherent limitations, Dr. Rouhani also conducted a more comprehensive analysis that included concurrent comparisons of Mr. Sullivan's predicted results against actual observations. In this evaluation, Dr. Rouhani compared the results of Mr. Sullivan's air quality model with the air quality measurements for the same location and the same period in time (for lead and arsenic, a daily average; for SO_2 , the hourly value). In this analysis, Dr. Rouhani found that Mr. Sullivan's model not only fails the factor-of-two test but fails miserably, as the vast majority of modeled results fall well outside that range, meaning that these results either significantly over-estimated or under-estimated actual air quality measurements. (*Id.* ¶¶ 22–25 & Attachment C.) As for lead, Dr. Rouhani found that Mr.

Sullivan’s modeled daily averages failed to meet the factor-of-two test more than 75% of the time. (*Id.* ¶ 24.) The results for lead using this concurrent comparison are set forth in Dr. Rouhani’s Figure 2, excerpted below. Note that the results falling outside of the two dotted red lines either over-estimate or under-estimate measured values by more than a factor of two.



B. Modeled-to-Modeled Comparisons

In a final point of comparison, Dr. Rouhani addressed Mr. Sullivan’s assertion that the three different models he considered produced “generally similar results” with “similar general magnitude.” (Sullivan 2020 Report at 27; *see also id.* at 9, 26.) As noted by Dr. Rouhani, however, Mr. Sullivan provides no statistical basis or explanation to substantiate this conclusion regarding his purported model-to-model comparison. (Rouhani 2021 Report ¶ 26.) Further, when Dr. Rouhani performed the calculations needed to compare the three models, he found that they were not, in fact, “generally consistent” and that there were significant variations. (*Id.* ¶¶ 27–28.) When comparing the “Sullivan-Sullivan” modeled results to the “Sullivan-McVehil” results, for example, Dr. Rouhani found—using data supplied by Mr. Sullivan himself—that 67% of lead concentrations fell outside the acceptable range. (*Id.* ¶ 27.) In other words, “fully two-thirds of Mr. Sullivan’s model results fail the factor-of-two reliability test.” (*Id.*)

III. LEGAL ARGUMENT & CITATION OF AUTHORITIES

A. Legal Standard

Federal Rule of Evidence 702 governs the admissibility of expert testimony, providing that witnesses who are qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if: “(a) the expert’s scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has reliably applied the principles and methods to the facts of the case.” Contrary to Plaintiffs’ assertions otherwise, Dr. Rouhani’s opinions fully satisfy these requirements.

B. Dr. Rouhani Is Exceptionally Well Qualified to Offer the Statistical Analyses Challenged Here

As an initial matter, Plaintiffs offer no serious objection to Dr. Rouhani’s qualifications to perform the statistical analyses contained in his Report. Nor could they, as he is eminently qualified to do so. Dr. Rouhani holds a Master of Science in Environmental Engineering (1980) as well as a Ph.D. in Environmental Sciences (1983), both from Harvard University. (Rouhani 2019 Report at 3, 33.) In 1990, he was awarded tenure and promoted to Associate Professorship at the Georgia Institute of Technology. (*Id.*) In 1995, Dr. Rouhani co-founded NewFields Companies, LLC, a leading environmental consulting firm where he continues to serve as President. (*Id.*) He is a licensed Professional Engineer and focuses his current practice on geostatistics and environmental statistics. (*Id.*) His work in these areas dates back to 1980, when he developed optimal geostatistical procedures for the analysis and monitoring of groundwater systems. (*Id.* at 3.) Dr. Rouhani later developed geostatistical algorithms to analyze environmental spatial datasets within geographical information system (“GIS”) databases. (*Id.*)

Over the course of his professional career, Dr. Rouhani has conducted work and research involving a wide variety of environmental statistical issues and published extensively on the topic, including authoring, among many other examples, a compendium on applications of geostatistics in environmental and geotechnical engineering; a series of standard guides for the American Society for Testing and Material (“ASTM”) involving geostatistics in environmental site investigations; and a four-volume guidance document addressing background data analysis for the U.S. Department of the Navy. (*Id.* at 4.) Moreover, during the past several decades, Dr. Rouhani has led numerous investigations and conducted research in environmental statistics and geostatistics, including taking a leading role in sampling design and analysis of environmental data on behalf of the U.S. National Oceanic and Atmospheric Administration (“NOAA”) as part of the Deepwater Horizon natural resource damage assessment.

Nevertheless, Plaintiffs complain that Dr. Rouhani is not himself an air quality modeler. (Dkt. No. 1248 at 5–6.) That, however, is no basis for excluding his statistical analysis of data generated by an air model. Indeed, Dr. Rouhani has conducted numerous statistical evaluations of air quality modeling results and air quality measurements. This includes research on air modeling for the U.S. Environmental Protection Agency while a tenured professor at Georgia Tech, air modeling work for Atlanta related to the Olympics, and additional air modeling evaluations in another half dozen confidential cases over roughly the last six years, with the most recent project being last year. (Ex. D, Deposition of Shahrokh Rouhani, Ph.D., PE, at 10:10–11:4, 29:20–25, 79:1–80:9, 140:25–141:16 (Apr. 14, 2021) (“Rouhani Dep.”).) Further, Dr. Rouhani’s air modeling work has involved the quantitative assessment of air models including the comparison of predicted modeled values to actual measured results. (*Id.* at 12:3–15, 13:6–11, 113:15–19.)

In this matter, Dr. Rouhani did not undertake an evaluation of whether Mr. Sullivan properly built his air quality model, properly calculated emission and other inputs, or properly ran the CALPUFF model itself. Instead, his task was to respond to Mr. Sullivan’s statistical characterizations about his model using the data produced by Mr. Sullivan himself. There is no serious question that Dr. Rouhani is more than qualified to do so. Further, in the end, Plaintiffs’ criticisms all center on whether it was proper for Dr. Rouhani to perform concurrent comparisons as part of his evaluation of Mr. Sullivan’s claims. As detailed below, there can be no serious question that this analysis was in fact proper. Indeed, as explained at the outset, Plaintiffs’ own technical citations demonstrate that fact. *See Lauzon v. Senco Prods., Inc.*, 270 F.3d 681, 693 (8th Cir. 2001) (finding as scientifically reliable expert’s opinions based on research and analysis that had been subjected to normal scientific scrutiny through peer review and publication).

C. Dr. Rouhani Properly Used Mr. Sullivan’s Own Data Sets to Evaluate Mr. Sullivan’s Own Claims

Plaintiffs next complain that Dr. Rouhani in his concurrent comparisons should have used monthly averages rather than daily results (for lead and arsenic) or hourly values (for SO₂). This argument too rests on a faulty premise. It is Mr. Sullivan who first asserted—without qualification, quantification, or explanation—that his modeling results “are *generally consistent* with the . . . measured air quality data for lead and SO₂.” (Sullivan Dec. 2020 Report at 26 (emphasis added).) Having made that blanket, overarching assertion, Mr. Sullivan and the Plaintiffs can hardly complain that Dr. Rouhani scrutinized the claim for accuracy. That is precisely what Dr. Rouhani has done.

As made explicit during his deposition, Dr. Rouhani for his 2021 Report took the modeled and measured data directly from Mr. Sullivan’s reliance materials provided to

Defendants in December 2020.² (Rouhani Dep. at 60:19–23, 101:24–25.) Dr. Rouhani then compared Mr. Sullivan’s measured and modeled results to determine whether or not they were “generally consistent,” as Mr. Sullivan had claimed. Dr. Rouhani found that “[r]egardless of the modeled emission treatment scenario and chemical, Mr. Sullivan’s model predictions display *extremely weak correlation* to their corresponding measured values.” (Rouhani 2021 Report ¶ 24 (footnotes omitted; emphasis added).) Dr. Rouhani further found that “most of Mr. Sullivan’s model predictions fail the factor-of-two agreement with their measured values,” including “more than 75% of the predicted lead concentrations.” (*Id.*)

Plaintiffs now criticize this evaluation, in part, on grounds that the data used by Mr. Sullivan to create his daily modeled values were based on monthly emissions figures. Plaintiffs further contend that Dr. Rouhani “mistakenly assumed” that Mr. Sullivan had used “daily inputs that could generate reliable daily outputs.” (Dkt. No. 1248 at 9.) Dr. Rouhani, however, did nothing of the sort. Rather, he took Mr. Sullivan’s statements on their own terms and subjected them to statistical testing. If, in fact, the modeled predictions and measured values compiled by Mr. Sullivan are not comparable, then Mr. Sullivan should not have asserted that they are “generally consistent.” The fact that Mr. Sullivan now claims (whether true or not) that it was impossible for him to generate more accurate daily predicted results is not a meaningful criticism

² The modeled and measured data pertinent here are contained in two excel files. The first file contains an excel sheet with the daily measured lead concentrations for 2007 placed side-by-side with the directly corresponding predicted model results for lead for those same days. (Ex. E, Sullivan Reliance Materials, “MODEL-PERFORMANCE-ADJ-HEIGHT (2.5)-(LEAD-ARSENIC).xlsx”, sheet “DAILY-LEAD – PM10 – 2007.”) This file also contains a separate excel sheet that provides the same sort of daily measured and modeled values for arsenic. (Ex. F, Sullivan Reliance Materials, “MODEL-PERFORMANCE-ADJ-HEIGHT (2.5)-(LEAD-ARSENIC).xlsx”, sheet “DAILY-ARSENIC – PM10 – 2007.”) The second excel file contains the hourly measured results for SO₂ as well as the directly corresponding hourly modeled SO₂ results. (Ex. G, Sullivan Reliance Materials, “MODEL-PERFORMANCE-ADJ-HEIGHT (2.5)-(SO₂-PM10).xlsx”, sheet “SO₂ – 2007.”)

of Dr. Rouhani’s work, but instead demonstrates a weakness or deficiency with Mr. Sullivan’s model. And it is certainly not a basis for excluding Dr. Rouhani’s expert opinion where that opinion was based on information—including daily modeled predictions—provided by Mr. Sullivan in order to evaluate Mr. Sullivan’s assertions about the reliability of his model.

(Rouhani 2021 Report ¶ 24 nn. 7–9.) In any event, it is well established that “the factual basis of an expert opinion goes to the credibility of the testimony, not the admissibility, and it is up to the opposing party to examine the factual basis for the opinion in cross-examination.” *Bonner v. ISP Techs., Inc.*, 259 F.3d 924, 929–30 (8th Cir. 2001) (quoting *Hose v. Chi. Nw. Transp. Co.*, 70 F.3d 968, 974 (8th Cir. 1995)).

D. Dr. Rouhani’s Opinions Are Based on Reliable Principles and Methods

Further, Plaintiffs’ arguments for excluding Dr. Rouhani’s concurrent modeling comparisons as unreliable are baseless and should be rejected.

1. Dr. Rouhani’s Statistical Comparisons Respond Directly to Mr. Sullivan’s Generic, Unexplained, and Unsupported Statistical Claims

From the outset, Plaintiffs have failed to acknowledge the context in which Dr. Rouhani made the statistical comparisons and the conclusory, standardless statements from Mr. Sullivan to which Dr. Rouhani responds. In his December 2020 Report, Mr. Sullivan makes significant statistical claims about his modeling results, and yet provides no basis or methodology to support them. In particular, Mr. Sullivan asserts—in purely conclusory terms—that his new air modeling efforts and his prior air modeling work “are in *general agreement* regarding the magnitude of impacts.” (Sullivan Dec. 2020 Report at 26 (emphasis added).) He further claims—again without justification or support—that these modeling results “are *generally consistent* with the ... measured air quality data for lead and SO₂” (while “relatively low” for arsenic). (*Id.* (emphasis added).) The closest Mr. Sullivan comes to touching upon these questions in a substantive way is

to summarize, in Table E-5, the new “modeled” predictions (designated “SULLIVAN”), his prior 2019 “modeled” predictions (designated “CHEREMISINOFF”), and the corresponding “measured” observations obtained from local air monitoring stations. (*Id.* at 14–15.) The table itself, however, contains no evaluation or analysis of any sort.

Despite the lack of statistical or quantitative evidence, the absence of any stated methodology, and the failure to even explain his assertions in a meaningful way, Mr. Sullivan nevertheless asserts that the datapoints in Table E-5 are, without qualification, in “general agreement” and “generally consistent.” It is against the backdrop of these unexplained and unsubstantiated assertions that Dr. Rouhani provides his 2021 Report. (Rouhani 2021 Report ¶ 4.) Of course, it is Mr. Sullivan who prepared and thus must defend his air quality models. It is Mr. Sullivan who claims his two sets of modeled results “are in general agreement.” And it is Mr. Sullivan who professes that those results “are generally consistent with” measured concentrations. And yet, Mr. Sullivan’s claims rest on nothing more than his self-serving say so. This is insufficient under *Daubert* and its progeny. *See General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997) (holding that “nothing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert”). Dr. Rouhani, in contrast, has properly rebutted these generic claims using generally accepted statistical principles as evidence in support of his opinions. As compared to Mr. Sullivan’s conclusory assertions, Dr. Rouhani’s quantitative analyses constitute far more than sufficiently reliable responses for purposes of Rule 702.

2. Plaintiffs Have Ignored Dr. Rouhani’s Broader Statistical Analysis, Including His Use of Nonconcurrent Comparisons

In addition, Plaintiffs have failed to recognize Dr. Rouhani’s broader statistical analysis. To read Plaintiffs’ motion, one might think that Dr. Rouhani conducted no statistical evaluation

of Mr. Sullivan’s predicted results beyond the challenged concurrent comparison. But that is not the case. To the contrary, Dr. Rouhani actually began his analysis by conducting a nonconcurrent comparison of measured-to-modeled results. (Rouhani 2021 Report ¶¶ 18–21, Figure 1, Table 5, & Attachment B.) For this comparison, Dr. Rouhani used the maximum annual 3-month rolling average for lead, the annual average for arsenic, and the annual 99th percentile of the daily 1-hour maximum for SO₂, the same averaging periods referenced by Mr. Sullivan in a prior report involving different modeling. (Dkt. No. 1248-3, David A. Sullivan Expert Report, dated Feb. 17, 2019, at 137–39, Tables E-13, E-14, E-15 (“Sullivan 2019 Report”).)

Based on this evaluation, Dr. Rouhani found “that the vast majority of predicted values generated by Mr. Sullivan in his various modeling efforts—even using nonconcurrent comparisons—are outside of the USEPA’s 40% typical margin of error (USEPA 2017, p. 5209). Therefore, regardless of the emission treatment scenario, Mr. Sullivan’s models produce inaccurate results.” (Rouhani 2021 Report ¶ 21.) Beyond being merely inaccurate, Dr. Rouhani found that “Mr. Sullivan’s models display systematic biases by overestimating concentrations at the Sindicato Station, while underestimating concentrations at all other stations. These results clearly demonstrate the unreliability of Mr. Sullivan’s model under any of his emission treatment scenarios.” (*Id.*) Notably, Plaintiffs do not seek to exclude these opinions.

The question before the Court, therefore, is not whether it was proper to evaluate an air quality model using *only* concurrent comparisons of modeled to measured results, as that is not what Dr. Rouhani did. Instead, the question is whether it was appropriate to evaluate such a model using *both* concurrent and nonconcurrent comparisons, recognizing that each will have its strengths and weaknesses. On this point, Plaintiffs’ own authorities conclusively establish that Dr. Rouhani’s more comprehensive approach is not only permissible but recommended.

As noted at the outset, Professors Chang and Hanna begin their article—upon which Plaintiffs rely—by stating: “Because there is not a single best performance measure or best evaluation methodology, it is recommended that a suite of different performance measures be applied.” Chang & Hanna at 167. They further explain: “Before beginning the calculation of various statistical performance measures, it is extremely useful to perform exploratory data analysis by simply plotting the data in different ways.” *Id.* at 172. Continuing further: “Multiple performance measures should be applied and considered in any model evaluation exercise, as each measure has advantages and disadvantages and there is not a single measure that is universally applicable to all conditions.” *Id.* at 173. Indeed, the recommendation to use a variety of different performance measures “in any model evaluation exercise” is a central and repeated theme of their article. *See also id.* at 183 (“There is not a single performance measure that is universally applicable to all situations, and a balanced approach is required to look at a number of performance measures.”).

That is precisely what Dr. Rouhani did in this case. In short, he conducted a more “comprehensive evaluation” that included both concurrent and nonconcurrent comparisons. (Rouhani 2021 Report ¶ 22.) Dr. Rouhani explains that he did so because “nonconcurrent comparisons can mask the inherent biases and weaknesses of Mr. Sullivan’s predictive models” (*id.*)—although, as explained above, even the nonconcurrent analyses demonstrate that Mr. Sullivan’s model is inherently flawed and unreliable.

Critically, and by way of contrast, Mr. Sullivan performed neither comparison in support of his December 2020 Report, nor did he undertake any other accepted method for evaluating the reliability of his new modeling effort. In their motion, Plaintiffs claim that Mr. Sullivan “was able to demonstrate his model’s successful performance for each toxin at issue.” (Dkt. No. 1248

at 5 (citing Sullivan 2019 Report at 67–68).) This is demonstrably false. To begin with, the citation for this assertion is a reference to Mr. Sullivan’s original expert report from February 2019. Of course, the modeling results discussed in that report are now obsolete and based on old emission estimates (originally prepared by the late Dr. Cheremisinoff). In response to those developments, Mr. Sullivan prepared a new emissions inventory and conducted new air modeling based on that inventory. He has failed, however, to demonstrate the successful performance of his new model (as conclusively shown by Dr. Rouhani). Further, Plaintiffs’ reference to Mr. Sullivan’s 2019 Report is entirely misplaced. The pages referenced there include no statistical comparison of predicted modeled values to actual measured results; instead, those pages address the manner in which the modeling predictions were determined. (*Id.*) Moreover, the modeling predictions cited in the 2019 Report were for the year 2006 (*id.* at 68), while Mr. Sullivan’s December 2020 Report instead focuses on 2007 (*see* Table E-5 at 14–15).

3. Contrary to Plaintiffs’ Contention, Pairing in Time and Space Is a Well-Recognized Model Evaluation Tool

In their motion, and contrary to the repeated recommendations of Chang and Hanna, Plaintiffs focus almost exclusively on the limitations of a single method of analysis, concurrent comparisons, considered in isolation. Indeed, Plaintiffs claim that this particular evaluative effort is a “fruitless” exercise, is not a reliable or generally accepted, is not supported by peer-reviewed publications, and has not been subject to testing. (Dkt. No. 1248 at 7–8.) These assertions are all false, as confirmed by Professors Chang and Hanna as well as other authoritative publications.

Dr. Rouhani never suggested that Mr. Sullivan’s modeling predictions should “perfectly match monitoring data,” or that his models must “accurately and consistently predict[] air concentrations at every specific time and place.” (Dkt. No. 1248 at 7 (internal quotation marks and citation omitted).) Rather, Dr. Rouhani expressly references the limitations of air quality

models and notes the “factor-of-two” margin for error cited by Mr. Sullivan. (Rouhani 2021 Report ¶¶ 23, 24) The essential point, however, as Chang and Hanna make clear, is that different methods of evaluation have different advantages, making it “extremely useful to perform exploratory data analysis by simply plotting the data in different ways.” Chang & Hanna at 172.

This includes conducting concurrent comparisons as carried out by Dr. Rouhani, as Chang and Hanna specifically note: “Some of the commonly-used plots are scatter plots, quantile–quantile plots, residual box plots, and *simply plots of predictions and observations as a function of time or space*.” *Id.* (emphasis added); *see also id.* at 171 (“[I]t is important to define how predictions are to be compared with observations. For example, should observations and predictions be paired in time, in space, or in both time and space? Different conclusions can be reached depending on the type of pairing chosen.”); *id.* at 173 (noting use of “[p]airing in both time and space”); *id.* at 192, 194 (discussing modeling exercise in Salt Lake City, Utah evaluating model performance using observations paired in time and space). Chang and Hanna further discuss the advantages of scatter plots in this context where “*paired observations and predictions* are plotted against each other” explaining that:

Visual inspection can reveal the magnitude of the model’s over or under-predictions. Also, as implied by its name, the scatter of the points can be quickly seen and estimated by eye (factor of 2, 5, or 10?). Because of the obvious impacts on the public health due to high pollutant concentrations or dosages, the high end of the plots can be studied. On the other hand, correct predictions of low concentrations may sometimes also be important for highly toxic chemicals.

Id. at 172 (emphasis added). Of course, this sort of scatter plot with “paired observation and predictions plotted against each other” is exactly what Dr. Rouhani did in this case, as reflected in his Figure 2 excerpted above the additional figures contained in Attachment C.

To support the contrary view, Plaintiffs cherry-pick a single quote from the Chang and Hanna article, which references the opinion of a different author in an article from thirty years

ago to the effect that it is “almost fruitless” to compare predictions and observations paired in space and time. *Id.* at 185. Chang and Hanna, however, reject that position. Indeed, in the very same paragraph that Plaintiffs quote, the Professors state as follows:

However, it is also recognized that there are applications such as emergency response, homeland security, and environmental justice, where it is necessary to predict the exposure to a population, in which case not only the magnitude, but also the location and shape of the concentration field are important. This is the reason why ***despite the challenge due to uncertainty in wind direction, there is nevertheless an interest in the paired in space or time comparisons.***

Id. (emphasis added). Given that Mr. Sullivan purports to use his model to support evidence of lead levels that individual Plaintiffs were allegedly exposed to, Dr. Rouhani’s concurrent comparisons are entirely appropriate.

There are, of course, other examples of concurrent comparisons in the peer-reviewed literature. For example, in *Performance Evaluation of AERMOD, CALPUFF, and Legacy Air Dispersion Models Using the Winter Validation Tracer Study Dataset*, 89 Atmospheric Env’t, 707 (2014) (Ex. H), Arthur S. Rood discusses the evaluation of various air quality models—*specifically including CALPUFF*—using both paired (concurrent) and unpaired (nonconcurrent) predictions and observations. The study helpfully explains why modeling efforts involving a prospective analysis (such as evaluating potential compliance with a regulatory standard going forward) are different from those where a retrospective assessment is needed (for example, to determine past exposures to a given dose). *Id.* at 708. For a retrospective assessment—such as when estimating past exposures like in this case—***“ultimately an unbiased estimate of the temporal and spatial distribution of air concentration and deposition with estimated uncertainty is desired.”*** *Id.* (emphasis added). Moreover, the study expressly finds that “Lagrangian puff models”—like CALPUFF—***“may be preferable for dose reconstruction*** where model domains can be large and where the assessment question is an ***unbiased estimate of***

concentration in time and space.” Id. at 718 (emphasis added). Indeed, the study found that these models “exhibit the smallest variance, highest correlation, and highest number of predictions within a factor of two compared to the steady state models at both the 8-km and 16-km distance.” *Id.* at 707.

Further, in *AERMOD Performance Evaluation for Three Coal-Fired Electrical Generating Units in Southwest Indiana*, 64 J. Air & Waste Mgmt. Ass’n (2014) (Ex. I), Kali D. Frost with the Indiana Department of Environmental Management likewise discusses model performance using matched pairs. She concludes: “In spite of these uncertainties [referencing wind direction and atmospheric transport], and considering the proposed use of modeling data for attainment demonstrations under the 1-hr SO₂ NAAQS standard, ***examination of both paired and unpaired data should be considered in a model evaluation.***” *Id.* at 281 (emphasis added).

In addition, as noted in Dr. Rouhani’s 2021 Report, concurrent comparisons are further supported by US EPA’s air quality model standard which states that “Any application of an air quality model may have deficiencies which cause estimated concentrations to be in error. ***When practical to obtain a measure of confidence in the estimates, they should be compared with observed air quality and their validity determined.***” U.S. Environmental Protection Agency, EPA-450/2-78-027, *Guideline on Air Quality Models*, 39 (1978) (Ex. J) (emphasis added).

In short, Plaintiffs’ purported basis for excluding Dr. Rouhani’s testimony regarding concurrent comparisons is incorrect. The peer-reviewed literature does in fact support such model evaluations, and indeed encourages it given the stated purpose of Mr. Sullivan’s model to show potential exposure levels for the individual Plaintiffs. Plaintiffs’ motion pursuant to Rule 702 should accordingly be denied. *See Lauzon*, 270 F.3d at 689 (reversing district court and

holding that a peer review article supporting an expert's proffered opinion weighs in favor of admitting the opinion under *Daubert* standard).

E. Plaintiffs' Complaints about Dr. Rouhani's Modeled-to-Modeled Comparisons Are Wholly Misplaced

Finally, Plaintiffs object to Dr. Rouhani's modeled-to-modeled comparisons as set forth in his Opinion 3. (Rouhani 2021 Report ¶¶ 26–28.) This set of comparisons, however, does not involve measured concentrations at all, in any form. Instead, Dr. Rouhani compared the predictions of Mr. Sullivan's different computer modeling runs *against each other*. Thus, there is no basis for complaining about the unpredictability of real-world wind patterns or other uncertainties in the environment. Plaintiffs cite no authority of any sort counseling against such a modeling comparison. Nor do they offer any reason why doing so is improper. Indeed, Plaintiffs only mention Opinion 3 at all in passing. (Dkt. No. 1248 at 6.) Regardless, Mr. Sullivan invited such a comparison when he asserted—without evidentiary basis or explanation—that his three modeling runs are “in general agreement.” (Sullivan Dec. 2020 Report at 26.) Even now, Mr. Sullivan has provided no statistical or quantitative evidence to substantiate this assertion, and Plaintiffs have no basis, technical or otherwise, for excluding Dr. Rouhani's response to the baseless claim. Indeed, the approach taken by Dr. Rouhani here is fully consistent with the balanced, multi-pronged method endorsed by Professors Chang and Hanna.

F. Dr. Rouhani's Opinions Should Not Be Excluded Under Rule 403

Finally, there is no justifiable basis for excluding Dr. Rouhani's opinions pursuant to Rule 403. The relevance of Dr. Rouhani's opinions is not outweighed by the danger of “unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence.” Fed. R. Evid. 403. At best, Plaintiffs' complaints go to the weight given to Dr. Rouhani's concurrent comparisons and not to their admissibility. Indeed,

Plaintiffs’ own reference to EPA guidance discussing air modeling in the regulatory context merely discourages “placing *too much weight* on modeled versus predicted concentrations paired in time and space.” (Dkt. No. 1248 at 8 (quoting U.S. Environmental Protection Agency, *Revisions to the Guideline on Air Quality Models: Enhancements to the AERMOD Dispersion Modeling System and Incorporation of Approaches To Address Ozone and Fine Particulate Matter*, 82 Fed. Reg. 5182, (Jan. 17, 2017) (emphasis added)).)

Again, as explained by Chang and Hanna, there is no single performance measure that is universally applicable to all situations to determine the reliability of an air model, and a balanced approach is required to look at a number of performance measures. That is precisely what Dr. Rouhani did, conducting both concurrent and nonconcurrent comparisons. The scientific literature confirms that the use of concurrent comparisons in this manner is both appropriate and advisable, particularly when modeling is intended to estimate potential past exposures to specific individuals, as in this case. To the extent Plaintiffs have criticisms of this scientifically recognized method, or how much weight Dr. Rouhani’s comparisons should be given, those are best suited for cross examination. *Bonner*, 259 F.3d at 929 (“even if the judge believes there are better grounds for some alternative conclusion, and that there are some flaws in the scientist’s methods, if there are good grounds for the expert’s conclusion, it should be admitted” (alteration omitted; quoting *Heller v. Shaw Indus., Inc.*, 167 F.3d 146, 152–53 (3d Cir. 1999)); *Asarco LLC v. NL Industries, Inc.*, 106 F. Supp. 3d 1015, 1024 (E.D. Mo. 2015) (“mere disagreement with assumptions and/or methodology does not warrant exclusion of expert testimony”).

IV. CONCLUSION

For the reasons stated above, Defendants respectfully request that the Court deny Plaintiffs’ motion to exclude, in any part, the expert opinions of Dr. Shahrokh Rouhani.

Respectfully submitted this 25th day of March, 2022.

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that on this 25th day of March, 2022, a true and correct copy of the foregoing was filed with the Clerk of the Court through the Court's CM/ECF system, which will affect service on all counsel of record by sending a Notice of Electronic Filing.

/s/ Geoffrey M. Drake